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Okuda et al.

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(54) **DRUG SOLUTION INSPECTION DEVICE AND DRUG SOLUTION INSPECTION METHOD**

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May 27, 2013 (JP) 2013-110878

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G06T 7/00 (2006.01)
G01F 23/02 (2006.01)

(52) **U.S. Cl.**
CPC ***G06T 7/0012*** (2013.01); ***G01F 23/02*** (2013.01)

(58) **Field of Classification Search**
CPC G06T 7/0012; G01F 23/02
See application file for complete search history.

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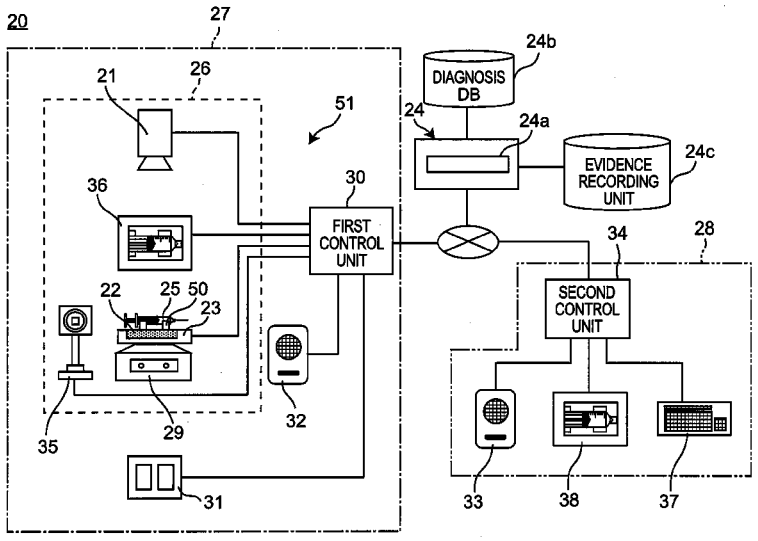
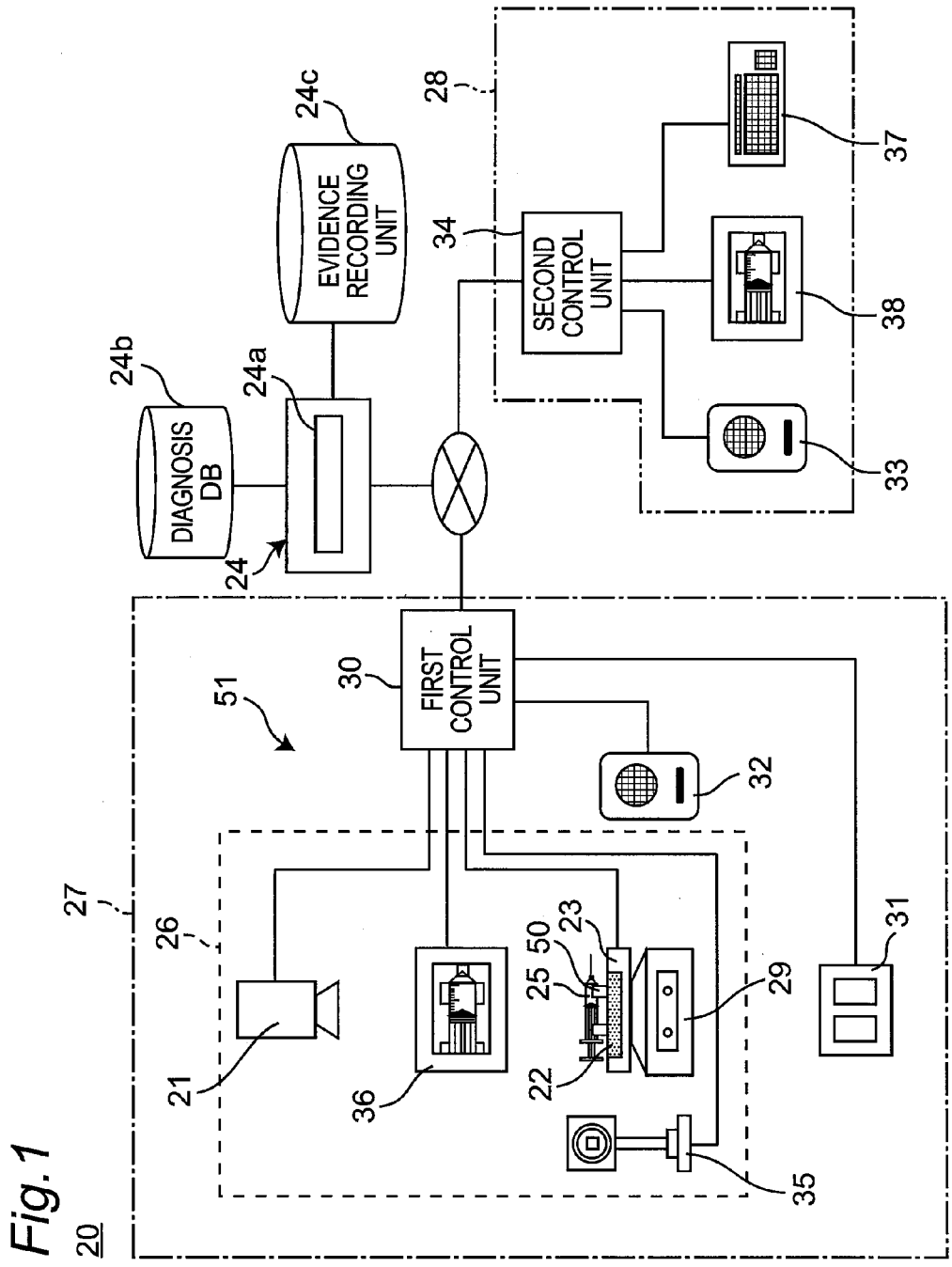
(74) *Attorney, Agent, or Firm* — Wenderoth, Lind & Ponack, L.L.P.

(57) **ABSTRACT**

A drug solution inspection device includes a jig that mounts thereon a syringe containing a drug solution, an imaging unit that captures an image of the syringe mounted on the jig, an exposure unit that performs exposure on the syringe mounted on the jig, and a first control unit that controls the imaging unit and the exposure unit to acquire inspection information. In order to inspect an amount of the drug solution in the syringe, the first control unit transmits the captured image of the syringe while changing an exposure state of the exposure unit.

12 Claims, 20 Drawing Sheets




20
27
26
51
28
24
24a
24b
24c
DIAGNOSIS DB
EVIDENCE RECORDING UNIT
SECOND CONTROL UNIT
FIRST CONTROL UNIT
21
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23
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30
31
32
33
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36
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50

Fig. 1

Fig.2

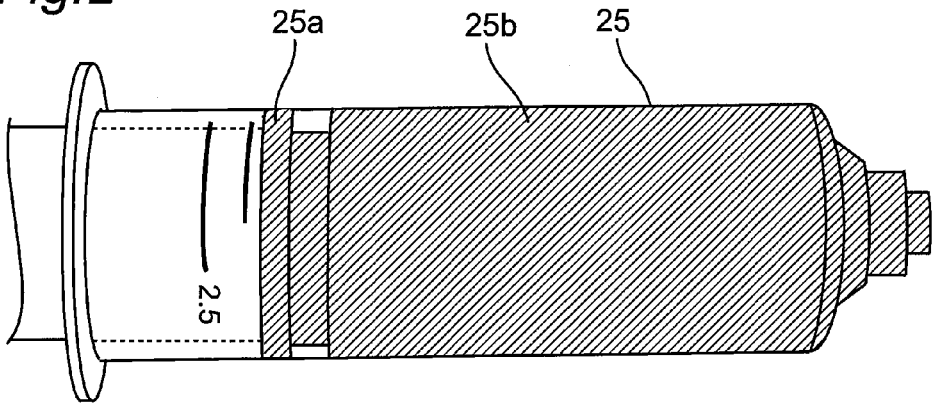


Fig.3

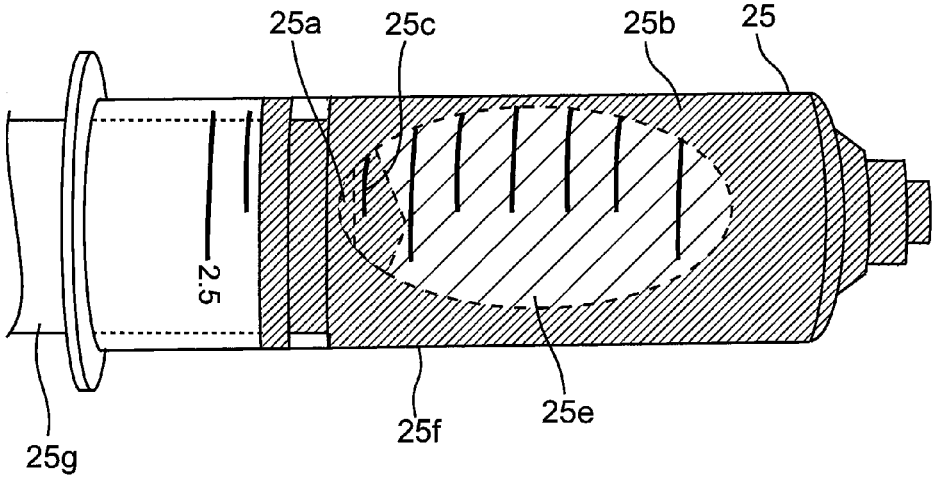
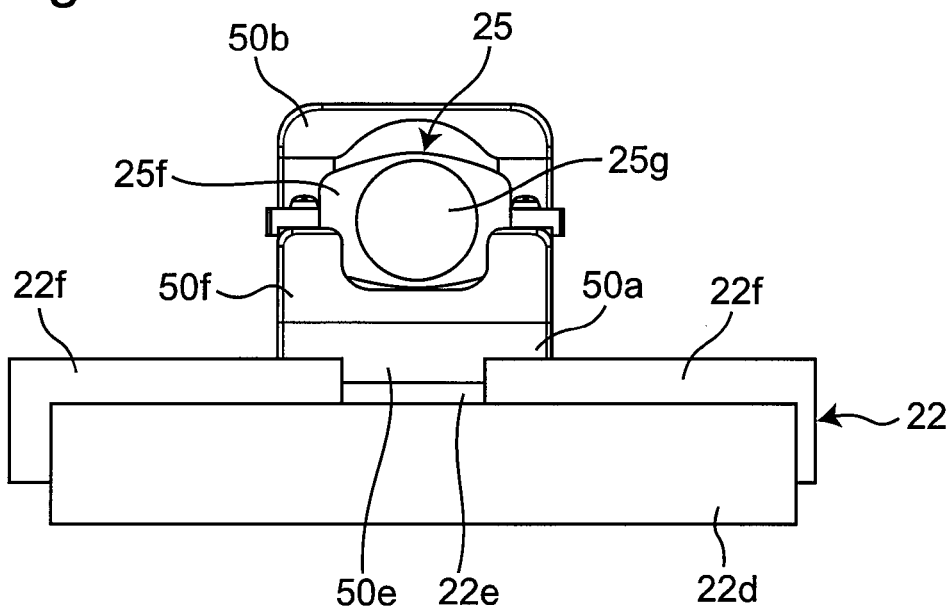


Fig.4



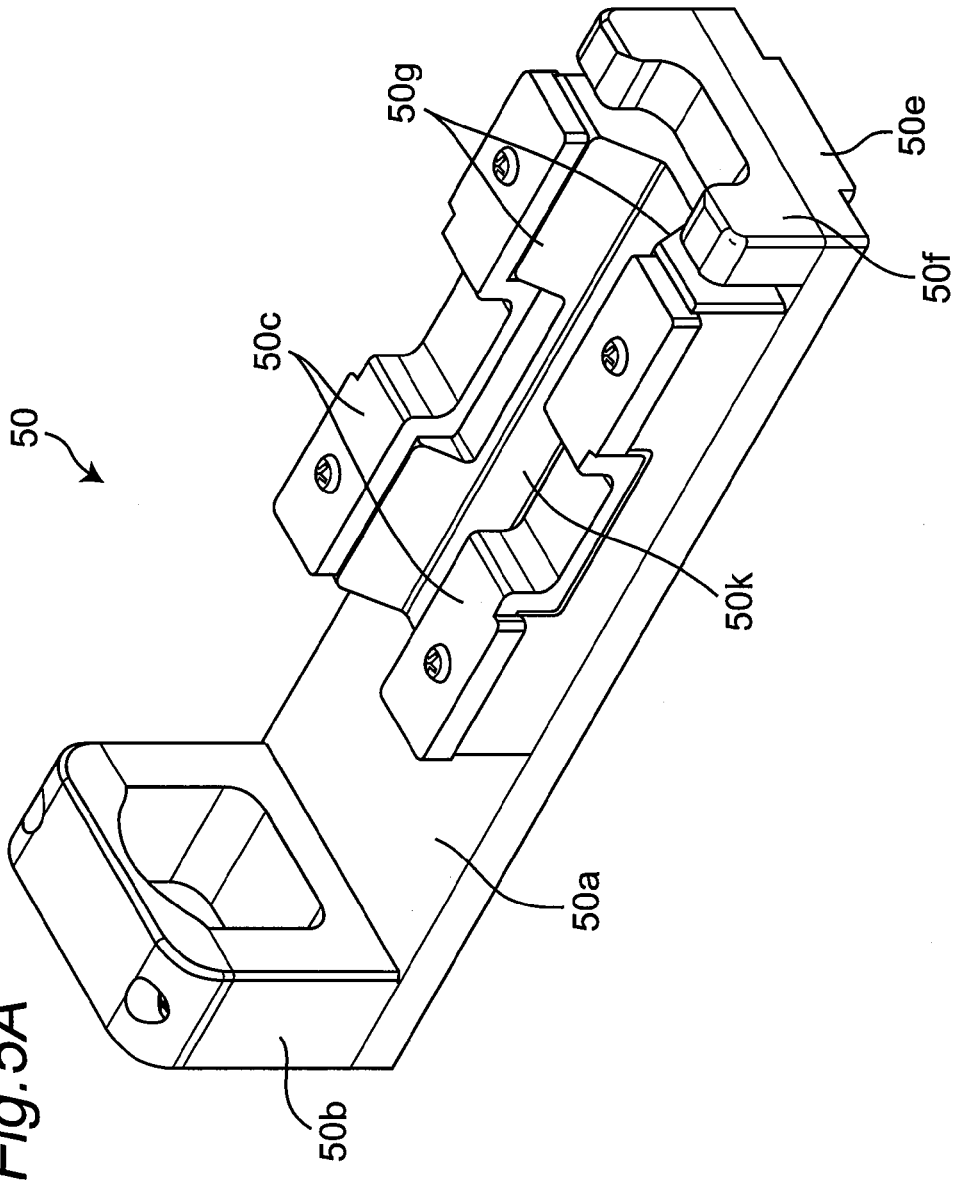


Fig.5A

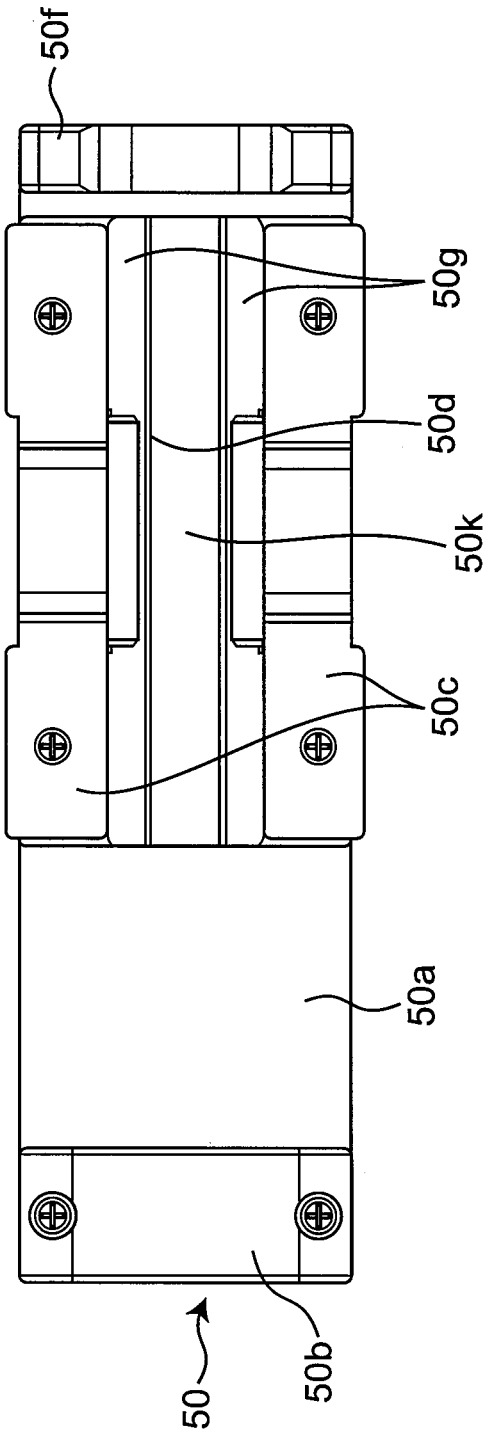


Fig.5B

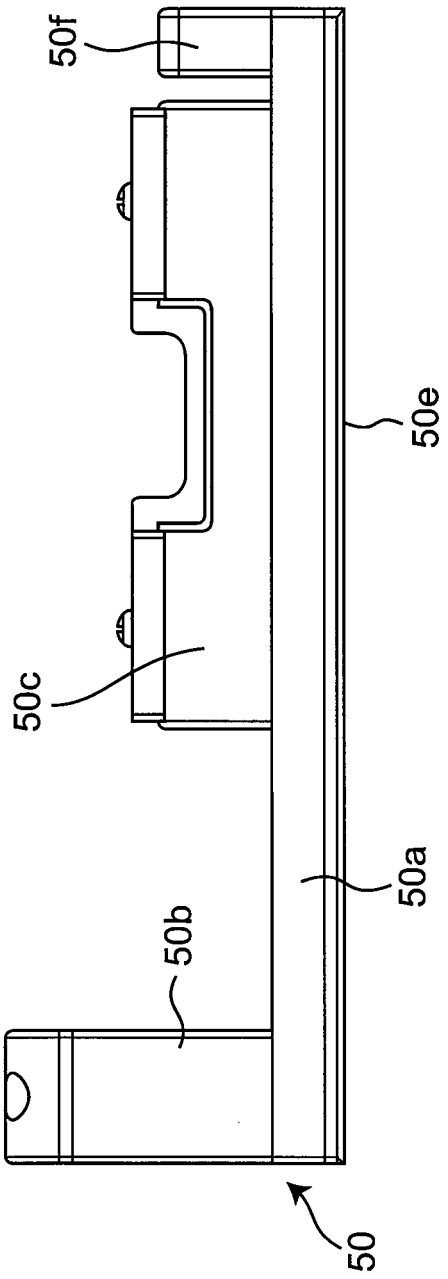


Fig.5C

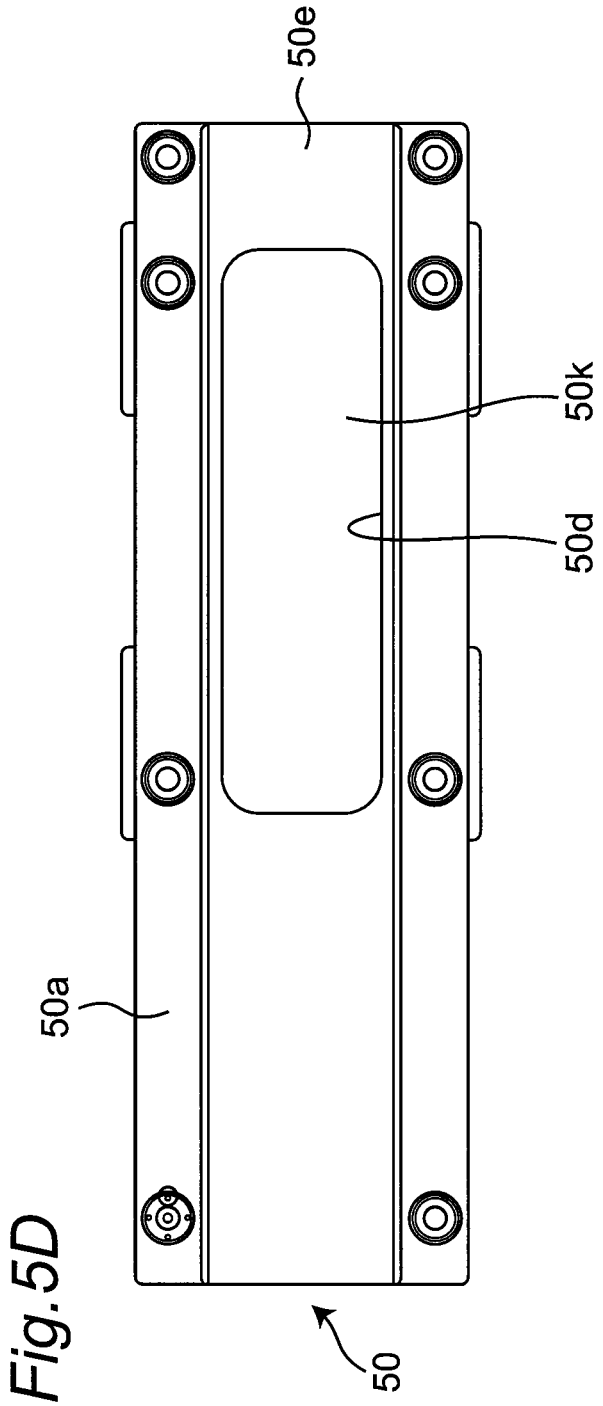


Fig.5D

Fig.5E

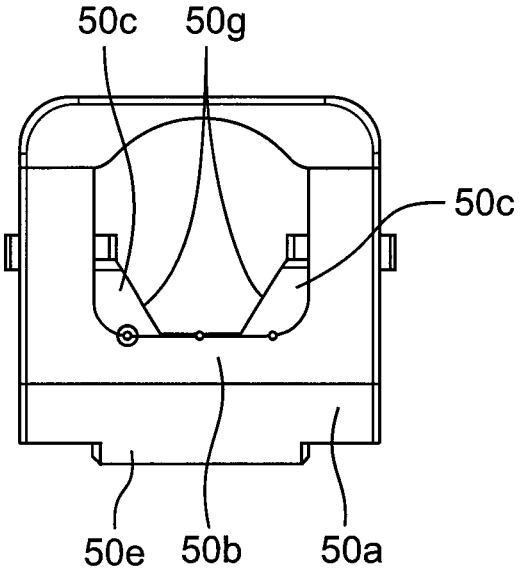
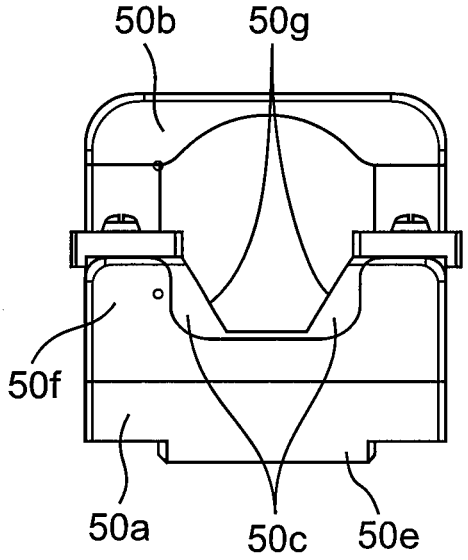


Fig.5F



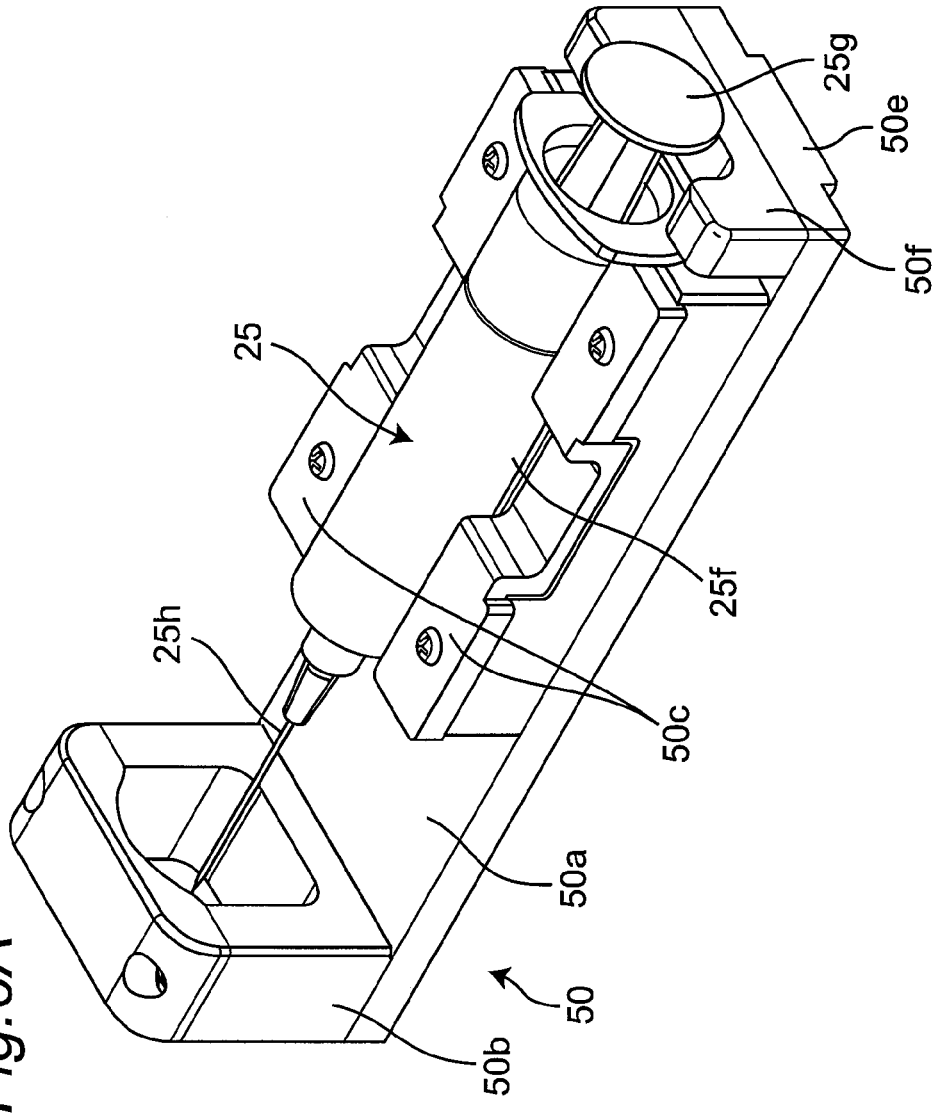


Fig.6A

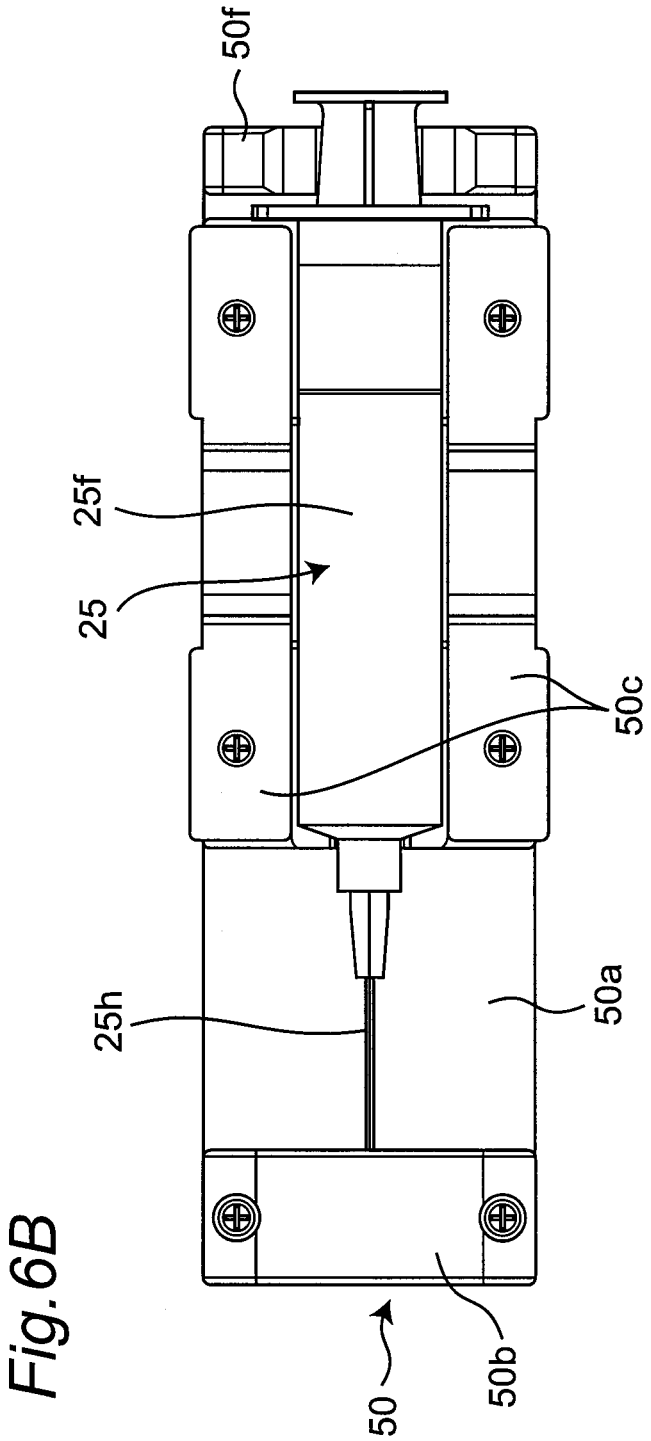


Fig.6B

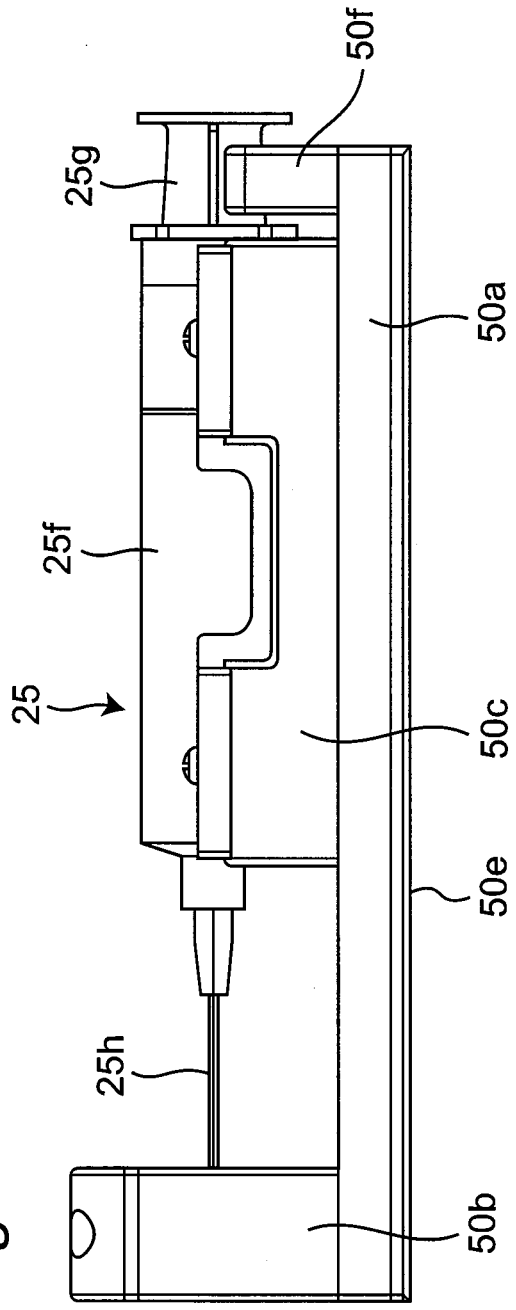


Fig.6C

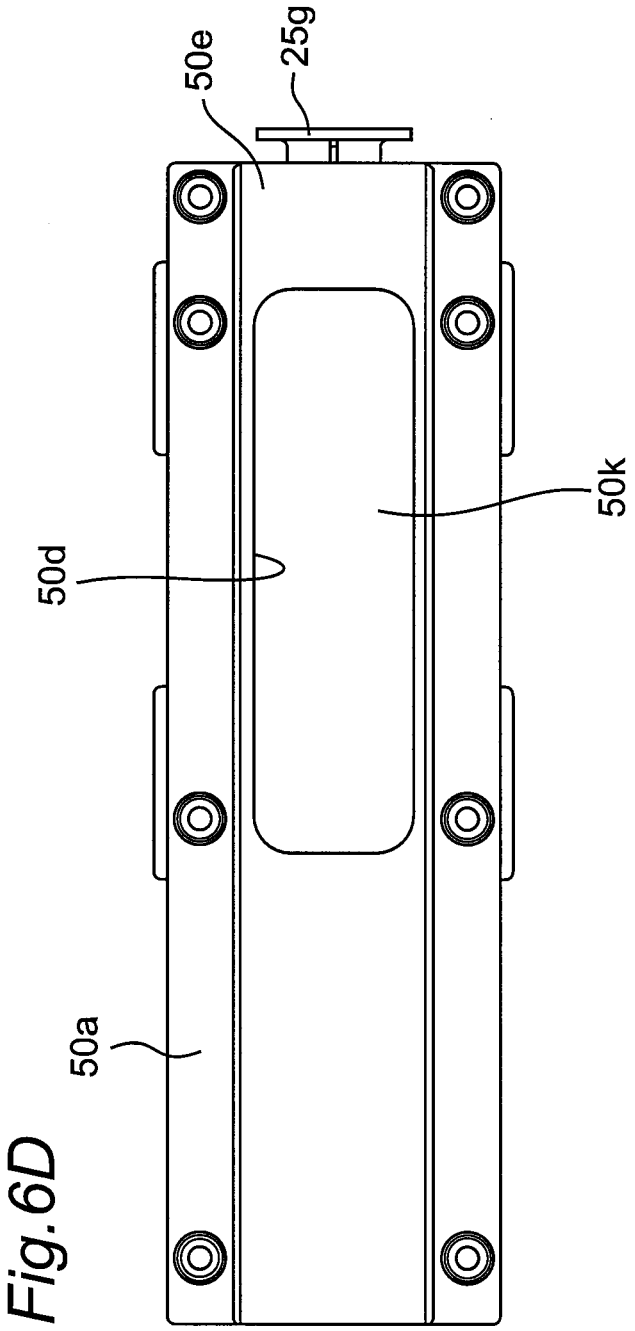


Fig.6D

Fig.6E

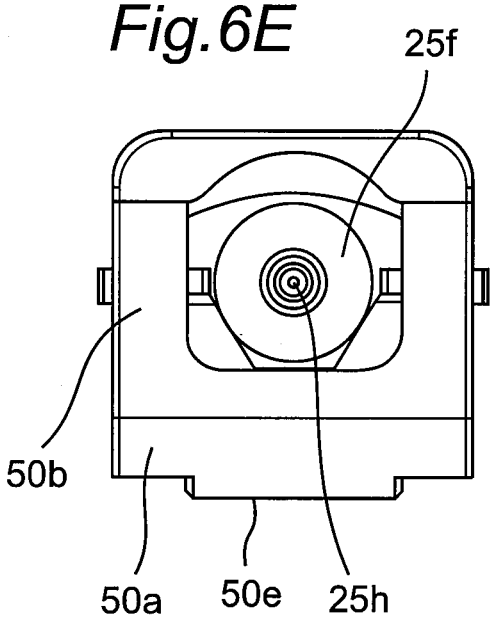


Fig.6F

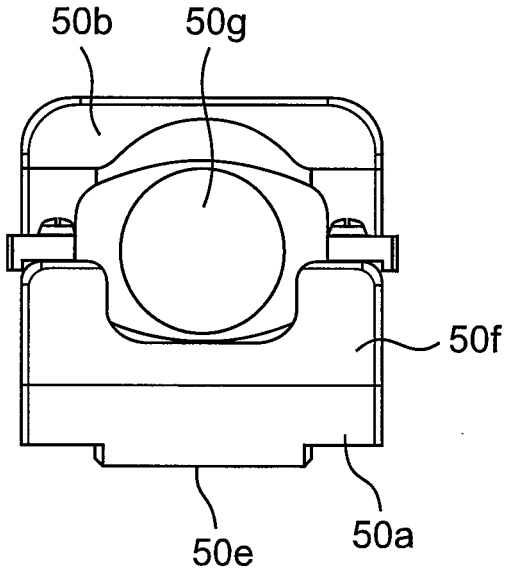


Fig.7A

SYRINGE CAPACITY(mL)	SYRINGE BODY DIAMETER(mm)
2.5	9.5
5	14.2
10	17.7
20	21.8
30	26.2
50	31.3

Fig.7B

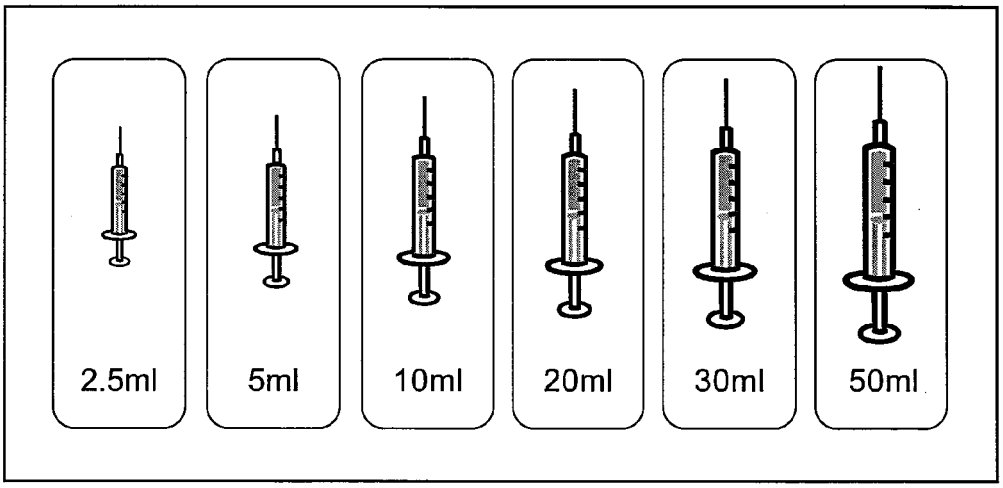


Fig.8A

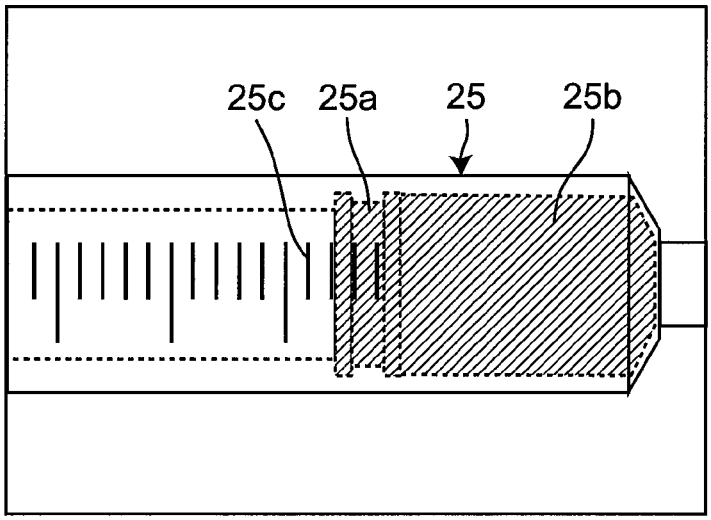
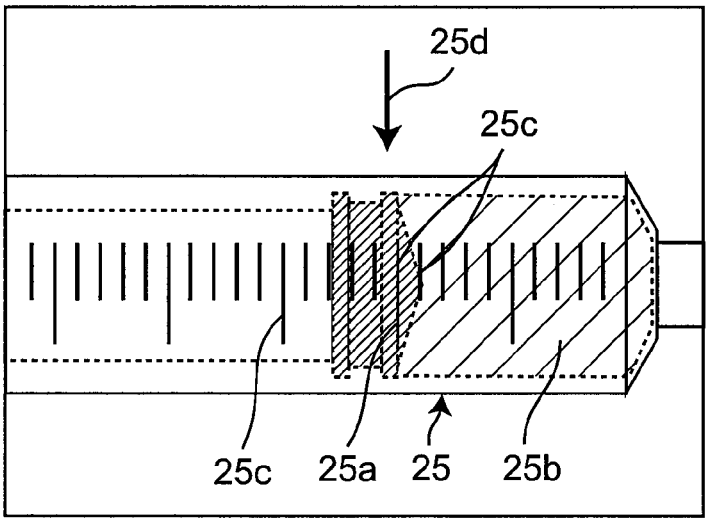


Fig.8B



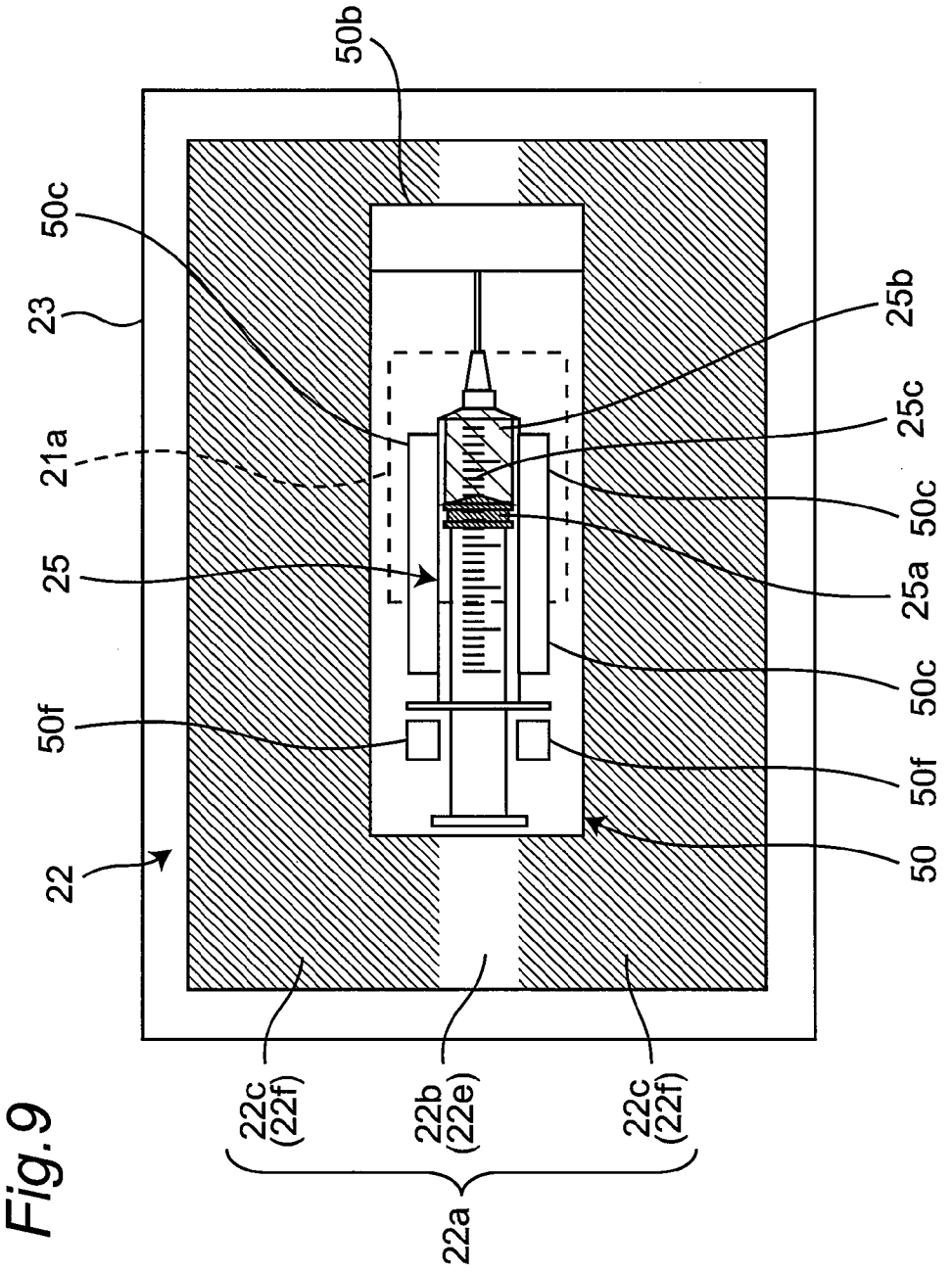

50b
50c
23
21a
25
50f
22
25b
25c
50c
25a
50c
50f
50
22c (22f)
22b (22e)
22c (22f)
22a

Fig.9

Fig.10

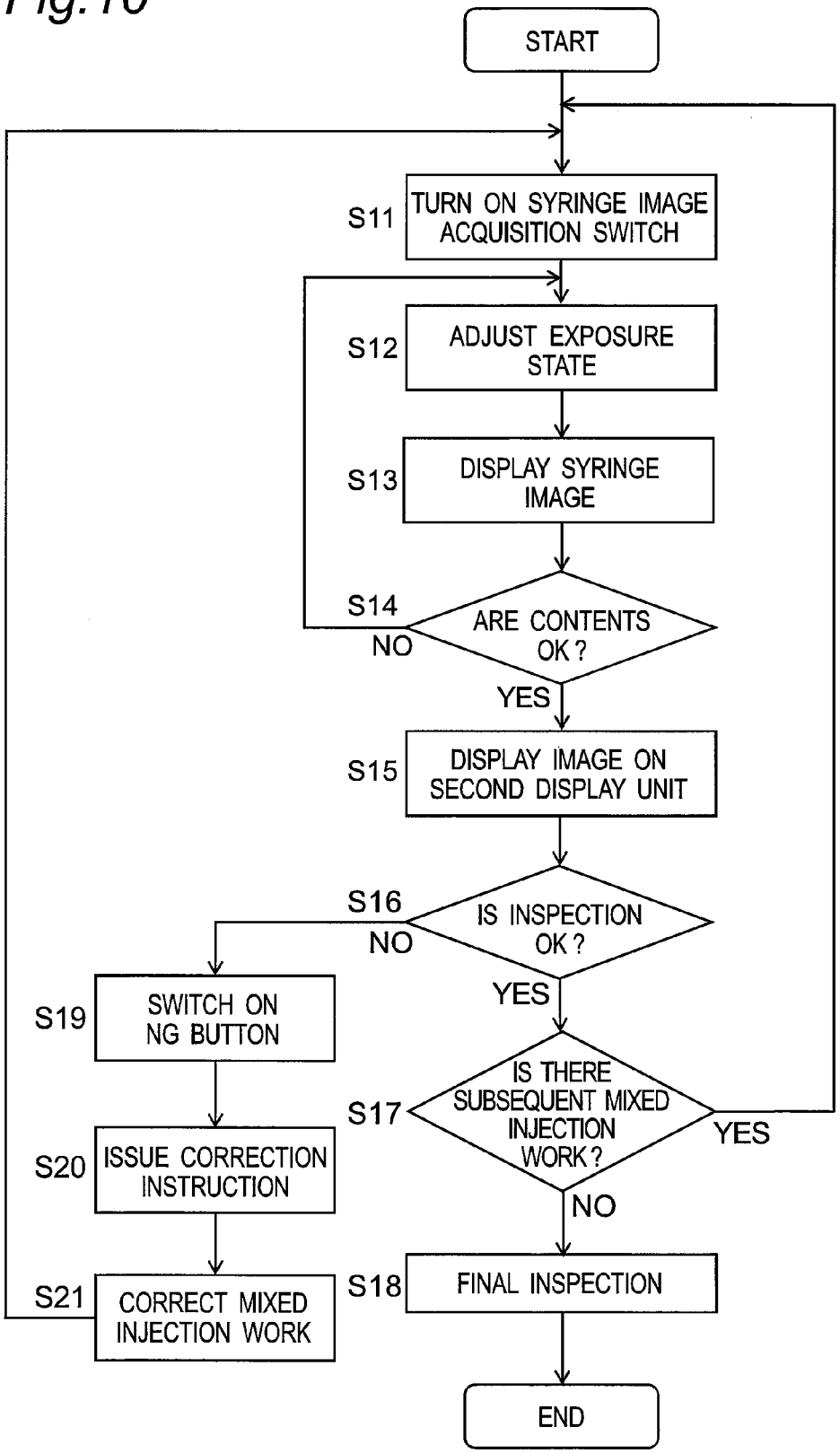

START
S11
TURN ON SYRINGE IMAGE ACQUISITION SWITCH
S12
ADJUST EXPOSURE STATE
S13
DISPLAY SYRINGE IMAGE
S14
ARE CONTENTS OK?
NO
YES
S15
DISPLAY IMAGE ON SECOND DISPLAY UNIT
S16
IS INSPECTION OK?
NO
YES
S19
SWITCH ON NG BUTTON
S17
IS THERE SUBSEQUENT MIXED INJECTION WORK?
YES
NO
S20
ISSUE CORRECTION INSTRUCTION
S21
CORRECT MIXED INJECTION WORK
S18
FINAL INSPECTION
END

Fig.11

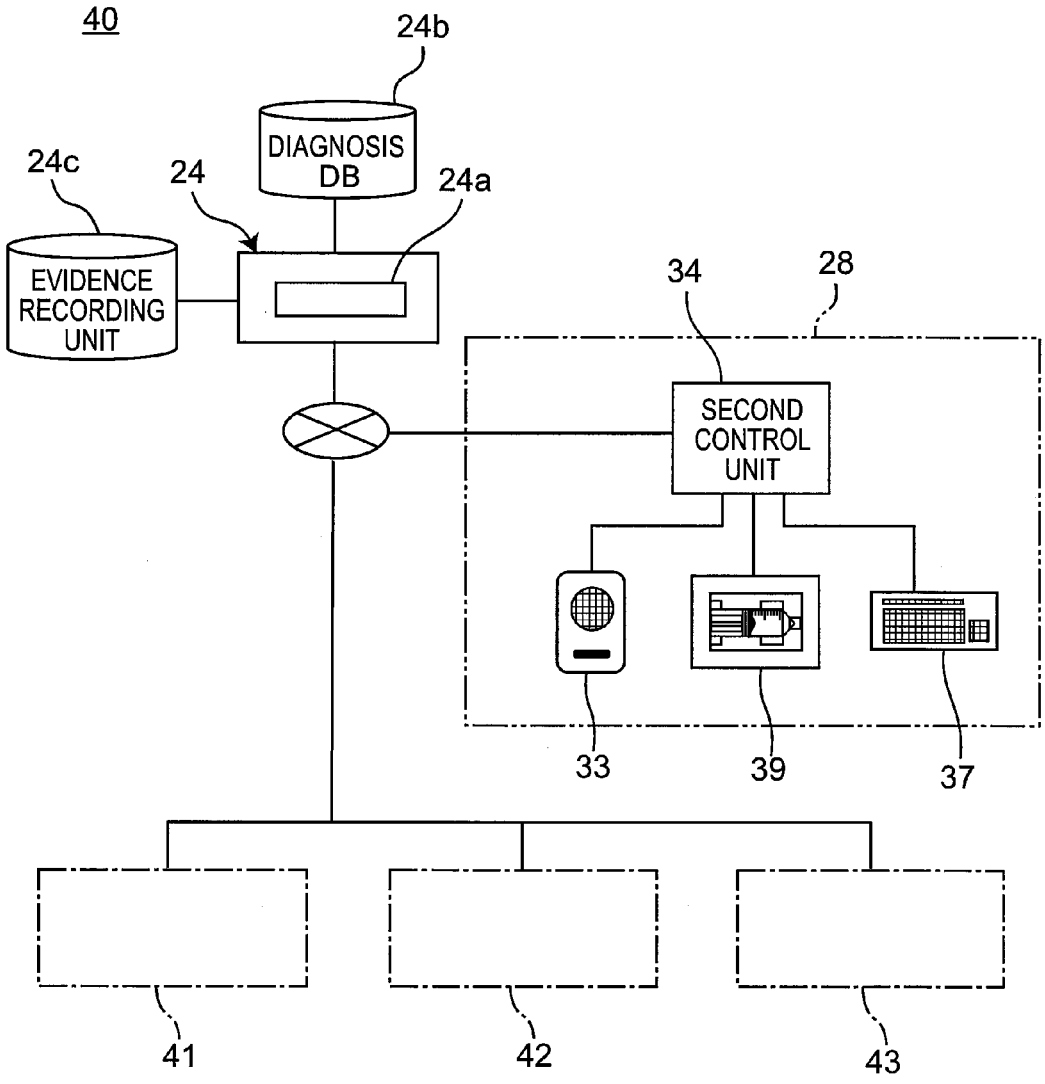

40
24b
DIAGNOSIS DB
24c
24
24a
EVIDENCE RECORDING UNIT
34
28
SECOND CONTROL UNIT
33
39
37
41
42
43

Fig.12

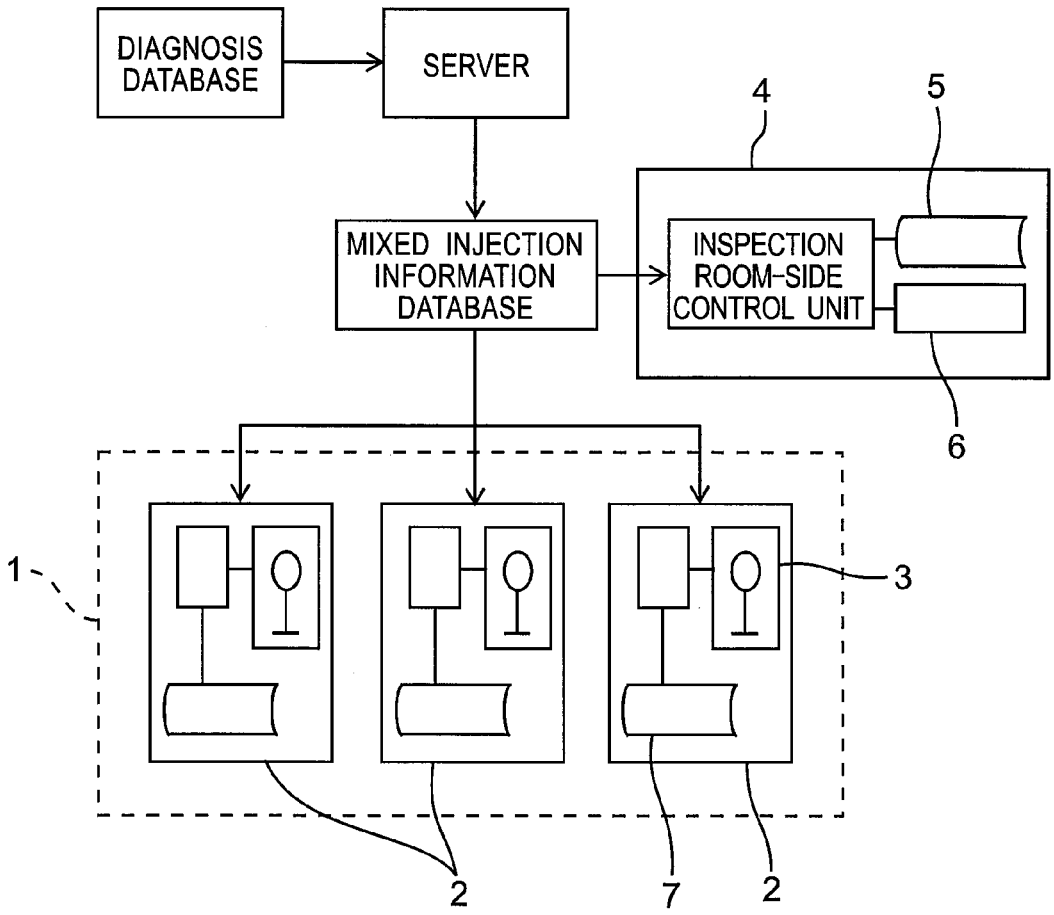
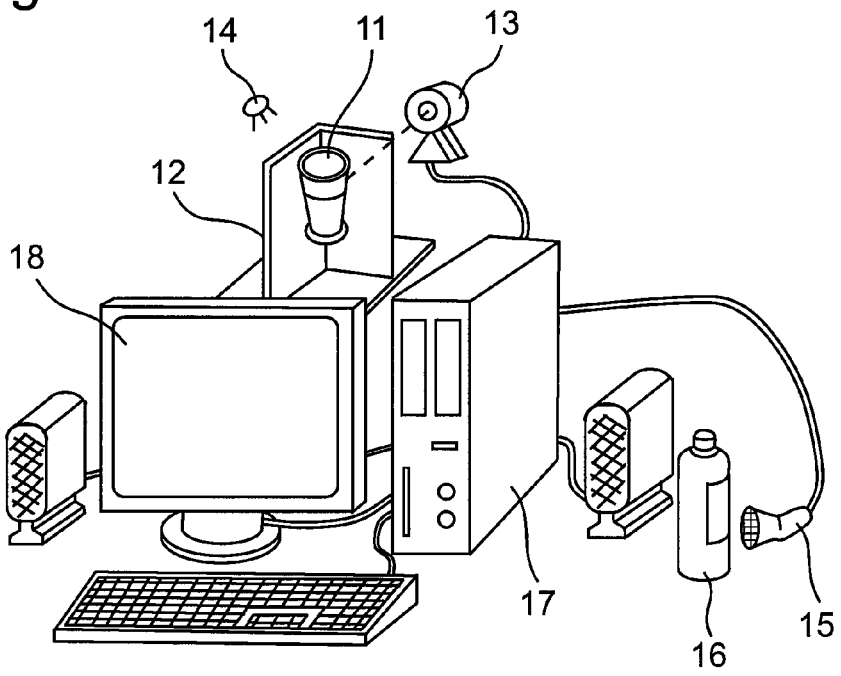

DIAGNOSIS DATABASE
SERVER
4
5
MIXED INJECTION INFORMATION DATABASE
INSPECTION ROOM-SIDE CONTROL UNIT
6
1
3
2
7
2

Fig.13



DRUG SOLUTION INSPECTION DEVICE AND DRUG SOLUTION INSPECTION METHOD

BACKGROUND OF THE INVENTION

The present invention relates to a drug solution inspection device and a drug solution inspection method, which are capable of inspecting, in a hospital and the like, an amount of a drug solution in a syringe as a work target at a place away from a worker.

In a hospital and the like, there is work of mixing and preparing an injection drug such as an anticancer drug (hereinafter, this work is referred to as mixed injection work).

In the case of performing the mixed injection work, it is necessary to safely manage this work, and also necessary for an inspector such as a pharmacist to inspect a series of work. Items to be inspected by the inspector include: items such as a dosage of the injection drug, which can be converted into numerical values; items such as a procedure of the mixed injection and as actions of the worker, which are difficult to be converted into numerical values; and the like. Therefore, in order to visually inspect the items which are difficult to be converted into numerical values, it is necessary for the inspector to stay close to the worker from the beginning to the end of the mixed injection work. Moreover, it is also frequent that one inspector inspects a plurality of pieces of mixed injection work performed at, different places. With regard to such an inspection as described above, not only efficiency of the work has been poor, but also the inspection has been a large workload for the inspector.

Accordingly, there has been proposed a system which enables inspection at a place away from a site of the mixed injection work, and reduces the load on the inspector (for example, refer to JP 2007-260390 A).

FIG. **12** is a configuration view of a mixed injection inspection system of JP 2007-260390 A. The mixed injection inspection system shown in FIG. **12** is a system that allows the inspector to inspect mixed injection work using syringes (not shown). In each of preparation rooms **2** of a clean room **1** as a site of the mixed injection work, there are installed an imaging device **3** for capturing an image of the mixed injection work, and a display unit **7** on the worker's side. The display unit **7** displays, to the worker, contents which are inputted by an input device **6** of an inspection room **4**. Moreover, the inspection room **4** for inspecting the mixed injection work is provided at a place away from the clean room **1**. In the inspection room **4**, there are installed a display unit **5** on the inspector's side, and the input device **6** for inputting an instruction issued from the inspector to the worker. The display unit **5** displays, to the inspector, the image of the mixed injection work captured by the imaging device **3**.

With such a configuration, for such mixed injection work by a plurality of the workers in a plurality of the preparation rooms **2**, the mixed injection inspection system of JP 2007-260390 A enables one inspector to issue precise instructions to the individual workers from one inspection room **4**, and to inspect a series of the mixed injection work. As described above, the inspector performs inspection work at a place away from the site of the mixed injection work, whereby work efficiency thereof can be enhanced, and the load on the inspector can be reduced.

Meanwhile, there has been proposed a drug solution inspection system for accurately observing an amount of a drug solution for use in the mixed injection (for example, refer to JP 2007-93465 A).

FIG. **13** is a configuration view of the drug solution inspection system of JP 2007-93465 A. In the inspection system shown in FIG. **13**, in order to accurately read a liquid level of a drug solution in a measuring device **11**, the measuring device **11** is vertically positioned in front of a camera **13** by a calibration unit **12**. Then, an image of a vicinity of the liquid level of the drug solution in the measuring device **11** is captured together with a scale of the measuring device **11** by the camera **13**. Moreover, in order that the vicinity of the liquid level of the drug solution can be clearly seen, the measuring device **11** is irradiated with illumination light by an illumination unit **14**. Furthermore, a type of a drug solution **16** and the captured image are associated with each other by an identifying unit **15**, and are stored in a personal computer **17**, and information is displayed on a monitor **18**.

However, in the mixed injection inspection system of JP 2007-260390 A, if general interior illumination or natural light is used at the time of capturing the image of the injection drug in the syringe (not shown), the inspection work cannot be performed in some cases since an accurate amount of the injection drug cannot be grasped. Specifically, for example, when the syringe contains an injection drug with a dark color, a gasket of the syringe and the injection drug with a dark color may be assimilated with each other chromatically, and a position of the gasket of the syringe cannot be grasped only by observing the image captured by the imaging device **3**, and it is difficult to grasp the amount of the injection drug.

Here, there is assumed a case of using the drug solution inspection system of JP 2007-93465 A in order to grasp the accurate amount of the injection drug. The illumination section **14** of the drug solution inspection system of JP 2007-93465 A corrects brightness of a place where the measuring device **11** is placed, and solves a shortage of a quantity of the illumination light in the vicinity of the liquid level of the drug solution. Hence, even in the case of using the drug solution inspection system of JP 2007-93465 A, if the syringe is used as the measuring device **11**, the gasket of the syringe and the drug solution with a dark color may be assimilated with each other chromatically, and it is difficult to grasp the accurate amount of the drug solution only by observing the image captured by the camera **13**. Therefore, even in the case of using the drug solution inspection system of JP 2007-93465 A for the mixed injection inspection system of JP 2007-260390 A, it is difficult to grasp the amount of the drug solution.

SUMMARY OF THE INVENTION

The present invention solves this problem. It is an object of the present invention to provide a drug solution inspection device and a drug solution inspection method, which are capable of grasping an accurate amount of a drug solution even if the drug solution has a dark color, and capable of performing accurate inspection.

In order to achieve the foregoing object, a drug solution inspection device according to an aspect of the present invention is characterized in that in a drug solution inspection device which captures an image of a syringe that contains a drug solution and inspects an amount of the drug solution in the syringe, the device comprising:

an imaging unit that captures an image of the syringe mounted on a jig;

an exposure unit that performs exposure on the syringe mounted on the jig; and

a first control unit that controls the imaging unit and the exposure unit to acquire inspection information of the drug solution,

wherein the jig has a transmitting portion provided in a region having a width substantially equal to a width of a cylinder of the syringe and at least including the cylinder of the syringe mounted thereon when viewed from above, and

the first control unit transmits, as inspection information, information of the captured image of the syringe in a state where the syringe is exposed by the exposure unit through the transmitting portion, to inspect the amount of the drug solution in the syringe.

In order to achieve the foregoing object, a drug solution inspection device according to another aspect of the present invention is characterized in that in a drug solution inspection device which captures an image of a syringe that contains a drug solution and inspects an amount of the drug solution in the syringe, the device comprising:

an imaging unit that captures an image of the syringe mounted on a jig;

an exposure unit that performs exposure on the syringe mounted on the jig; and

a first control unit that controls the imaging unit

and the exposure unit to acquire inspection information, wherein the first control unit transmits information of the captured image of the syringe in a state where the exposure unit is controlled to expose only a region having a width substantially equal to a width of a cylinder of the syringe and at least including the cylinder of the syringe, to inspect the amount of the drug solution in the syringe.

Moreover, in order to achieve the foregoing object, a drug solution inspection method according to the present invention is characterized in that in a drug solution inspection method which captures an image of a syringe that contains a drug solution and inspects an amount of the drug solution in the syringe, the method comprising:

capturing an image of the syringe by an imaging unit in a state where the syringe is irradiated with light having a width substantially equal to a width of a cylinder of the syringe; and

transmitting information of the captured image as inspection information to inspect an amount of the drug solution in the syringe.

In accordance with the aspects of the present invention, even if the drug solution has a dark color, a contrivance is made to the illumination for exposure on the syringe, whereby a boundary between the gasket of the syringe and the drug solution can be made clear, the position of the gasket can be reliably read, the accurate amount of the drug solution can be grasped, and the accurate inspection can be thereby carried out.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects and features of the present invention will become clear from the following description taken in conjunction with the preferred embodiments thereof with reference to the accompanying drawings, in which:

FIG. **1** is a schematic configuration view of a drug solution inspection system including a drug solution inspection device according to a first embodiment of the present invention;

FIG. **2** is a plan view in a case of inspecting an amount of a drug solution inside a syringe by a normal inspection base;

FIG. **3** is a plan view in a case of inspecting the amount of the drug solution inside the syringe by the drug solution inspection system according to the first embodiment of the present invention;

FIG. **4** is an explanatory view of an engaged state between an exposure unit and a jig of the drug solution inspection device;

FIG. **5**A is a perspective view of the jig of the drug solution inspection device;

FIG. **5**B is a plan view of the jig of the drug solution inspection device;

FIG. **5**C is a front view of the jig of the drug solution inspection device;

FIG. **5**D is a bottom view of the jig of the drug solution inspection device;

FIG. **5**E is a left side view of the jig of the drug solution inspection device;

FIG. **5**F is a right side view of the jig of the drug solution inspection device;

FIG. **6**A is a perspective view of a state where the syringe is mounted on the jig of the drug solution inspection device;

FIG. **6**B is a plan view of the state where the syringe is mounted on the jig of the drug solution inspection device;

FIG. **6**C is a front view of the state where the syringe is mounted on the jig of the drug solution inspection device;

FIG. **6**D is a bottom view of the state where the syringe is mounted on the jig of the drug solution inspection device;

FIG. **6**E is a left side view of the state where the syringe is mounted on the jig of the drug solution inspection device;

FIG. **6**F is a right side view of the state where the syringe is mounted on the jig of the drug solution inspection device;

FIG. **7**A is a table-format view showing an example of a relationship between a capacity and a width (body diameter) of the syringe;

FIG. **7**B is a view of a screen showing an input operation region of a touch panel of the drug solution inspection device, the input operation region for selecting a type of the syringe;

FIG. **8**A is a view showing a state where an image of the syringe is captured when there is no exposure from the exposure unit of the drug solution inspection device;

FIG. **8**B is a view showing a state where an image of the syringe is captured when there is an exposure from the exposure unit of the drug solution inspection device;

FIG. **9** is a plan view of a case of observing the syringe while changing an exposure state of the exposure unit of the drug solution inspection system according to the first embodiment of the present invention to a contrast pattern state;

FIG. **10** is a flowchart of preparation and inspection of an injection drug, which are carried out by using the drug solution inspection system according to the first embodiment of the present invention;

FIG. **11** is a schematic configuration view of a drug solution inspection system of another mode according to the first embodiment of the present invention;

FIG. **12** is a configuration view of a mixed injection inspection system of JP 2007-260390 A; and

FIG. **13** is a configuration view of a drug solution inspection system of JP 2007-93465 A.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A description is made below of embodiments of the present invention while referring to the drawings. Note that the same reference numerals are denoted to the same components, and a description thereof is sometimes omitted. The drawings mainly and schematically show the respective components for the purpose of facilitating the understanding.

(First Embodiment)

FIG. **1** is a configuration view schematically showing a drug solution inspection system **20** including a drug solution inspection device **51** according to a first embodiment of the present invention. FIG. **2** is a plan view of a case of inspecting an amount of a drug solution **25***b* in a syringe **25** by a normal

inspection base. FIG. **3** is a plan view of a case of inspecting the amount of the drug solution **25***b* inside the syringe **25** by the drug solution inspection system **20** according to the first embodiment of the present invention. The drug solution is an example of a drug, and for example, is an injection drug. The drug solution inspection system **20** of the first embodiment is an injection drug inspection system for performing preparation and inspection of the injection drug, for example.

The drug solution inspection system **20** of the first embodiment includes at least: an imaging unit **21**; an exposure unit **22**; a jig **50**; and a first control unit **30**. Moreover, the drug solution inspection device **51** is configured by the imaging unit **21**, the exposure unit **22**, the jig **50**, and the first control unit **30**. The first control unit **30** is an example of a control unit on the preparation side.

In the drug solution inspection system **20** of the first embodiment, the amount of the drug solution **25***b* in the syringe **25** fixed to the jig **50** is inspected in a state where the syringe **25** is placed on an inspection base **23** in a workroom **27**. The workroom **27** is, for example, a clean room for performing mixed injection work. At this time, if the syringe **25** contains the drug solution **25***b* with a dark color, such as a blackish drug, it is difficult to read a position of a scale **25***c* of a gasket **25***a*, as shown in FIG. **2**, by only placing the syringe **25** on the inspection base **23** through the jig **50**. This is believed to be because a tip end portion of the gasket **25***a* of the syringe **25** and the drug solution **25***b* with a dark color are assimilated with each other chromatically, and a boundary between the gasket **25***a* and the drug solution **25***b* cannot be identified. Note that, normally, the gasket **25***a* is a member constituted by rubber and the like and has a light blocking effect.

Accordingly, a first feature of the drug solution inspection device **51** of the first embodiment is that the drug solution inspection device **51** performs exposure from below on a region which includes at least the gasket **25***a* of the syringe **25**, by using the exposure unit **22** in a state where the exposure unit **22** is arranged on the inspection base **23**, and the syringe **25** is supported on the exposure unit **22** through the jig **50**.

At least a part of the syringe **25** is exposed by the exposure unit **22** through the jig **50**, and an image thereof is captured by the imaging unit **21**, whereby the boundary between the gasket **25***a* and the drug solution **25***b* can be made clear. This is believed to be because, an apparent color of the drug solution **25***b* is changed by exposing at least a part of the syringe **25** through the jig **50**, and an exposed bright exposure region **25***e* is formed on the captured image as shown in FIG. **3**. Then, as a result, the scale **25***c* of the syringe **25** for grasping the amount of the drug solution **25***b* becomes clearly identifiable.

The drug solution inspection system **20** of the first embodiment transmits, the captured image acquired as described above, to an inspection room **28** through the first control unit **30** from the imaging unit **21** of the workroom **27**, whereby an inspector in the inspection room **28** can perform inspection work for mixed injection work performed in the workroom **27**.

A description is made of a configuration of the entire drug solution inspection system **20** of the first embodiment.

As shown in FIG. **1**, the drug solution inspection system **20** of the first embodiment is configured by a server **24**, the workroom **27**, and the inspection room **28**.

The server **24** manages a preparation DB (preparation database) **24***a* regarding the drug solution **25***b*. The server **24** is connected to a diagnosis DB (diagnosis database) **24***b* and an evidence recording unit **24***c*.

A safety cabinet **26** is arranged in the workroom **27**. Inside the safety cabinet **26**, there are arranged the imaging unit **21**, the exposure unit **22**, the inspection base **23**, a measuring unit **29**, an identifying unit **35**, and a first display unit **36**.

Above the inspection base **23**, the imaging unit **21** is arranged downward at a position where an image of the syringe **25** supported on the inspection base **23** through the jig **50** can be captured. By control of the first control unit **30**, the imaging unit **21** captures the image of the syringe **25** that sucks or discharges the drug solution **25***b* (refer to FIG. **2**).

As shown in FIG. **4**, the exposure unit **22** is configured by a light source **22***d*, and light shielding covers **22***f* which have a light transmitting region **22***e* therebetween. The light shielding covers **22***f* are arranged on the light source **22***d* so as to cover an upper surface of the light source **22***d*. Light from the light source **22***d* passes through only the light transmitting region **22***e*, and a part of the syringe **25** is exposed from below. Portions other than the light transmitting region **22***e* are shielded by the light shielding covers **22***f*, and therefore, do not transmit therethrough the light from the light source **22***d*. The light transmitting region **22***e* is formed as a rectangular engagement recess on a center upper surface of the light source **22***d* in a width direction, and has a width equal to or more than a width of an opening portion **50***d* of the jig **50**. The engagement recess as the light transmitting region **22***e* is formed, for example, into a linear band shape extending along a longitudinal direction of the light source **22***d*. The exposure unit **22** is arranged at a position facing the imaging unit **21** with the syringe **25** and the jig **50** therebetween. For example, the light source **22***d* of the exposure unit **22** is an LED illumination device. In the case of using the LED illumination device as the light source **22***d* of the exposure unit **22**, even if the drug solution is a drug prone to be degraded by light, the drug solution can be exposed with a specific wavelength at which such degradation of the drug is less likely to occur. Moreover, heat generation of the LED illumination device is smaller as compared with those of other light sources, and deformation of the drug due to heat is also less likely to occur.

A second feature of the drug solution inspection device **51** of the first embodiment is that the drug solution inspection device **51** uses the light shielding covers **22***f*, and arranges the jig **50** on the exposure unit **22** to expose only a range substantially equal to a width of a cylinder **25***f*.

FIG. **5**A to FIG. **5**F are a perspective view, a plan view, a front view, a bottom view, a left side view, and a right side view of the jig **50**, respectively. FIG. **6**A to FIG. **6**F are a perspective view, a plan view, a front view, a bottom view, a left side view, and a right side view of a state where the syringe **25** is mounted on the jig **50**.

As shown in FIG. **5**A to FIG. **6**F, the jig **50** has: a rectangular bottom plate portion **50***a*; a tip end cover **50***b*; a pair of side portions **50***c*; a rear end protrusion **50***f*; and a transparent member **50***k*.

The bottom plate portion **50***a* has an opening portion **50***d* in a region including at least the cylinder **25***f* of the syringe **25** when viewed from above. The opening portion **50***d* is a rectangular through hole along a longitudinal direction of the bottom plate portion **50***a*. A width and a length of the opening portion **50***d* are substantially equal to a width and a length of the cylinder **25***f* which is a cylindrical portion of the syringe **25**. In the first embodiment, by making the width and the length of the opening portion **50***d* substantially equal to the width and the length of the cylinder **25***f*, light is radiated from the opening portion **50***d* so that unnecessary light does not enter the imaging unit **21**, and visibility of the cylinder **25***f* can be enhanced. The bottom plate portion **50***a* of the first embodiment is configured such that the light from the light source **22***d* of the exposure unit **22** arranged below the opening portion **50***d* can transmit therethrough toward the cylinder

25*f*. As such a configuration, for example, the opening portion **50***d* has a configuration in which a rectangular through hole is provided along the longitudinal direction of the bottom plate portion **50***a*, or a configuration in which the transparent member **50***k* is fitted and arranged in the opening portion **50***d* as shown in FIG. **5**A to FIG. **6**F. In the first embodiment, the opening portion **50***d* as the through hole and the transparent member **50***k* provided in the opening portion **50***d* are collectively referred to as a transmitting portion. As shown in FIG. **5**A to FIG. **6**F, in the case of forming the transparent member **50***k* and the side portions **50***c* as one member, a cover only needs to be provided on the transparent side portions **50***c*, and the like.

The tip end cover **50***b* is arranged so as to be erected on a tip end of the bottom plate portion **50***a* in the longitudinal direction, and covers a tip end of a needle **25***h* of the syringe **25**. The tip end cover **50***b* covers the tip end of the needle **25***h*, and thereby prevents a worker from erroneously touching the tip end of the needle **25***h*.

A pair of side portions **50***c* are arranged along the longitudinal direction of the bottom plate portion **50***a* so as to be erected on both sides thereof with the opening portion **50***d* therebetween. The pair of side portions **50***c* make contact with side portions of the syringe **25** from both sides to sandwich the side surfaces of the syringe **25**. On inner surfaces of the pair of side portions **50***c*, which are opposite to each other, there are respectively formed inclined surfaces **50***g* which make contact with an outer circumferential surface of the syringe **25** and perform position regulation for a lateral direction of the syringe **25**.

The rear end protrusion **50***f* sandwiches a flange on a rear portion of the syringe **25**, and prevents deviation and drop of the syringe **25** in an axial direction.

Moreover, on a back surface of the bottom plate portion **50***a*, there is formed an engagement protrusion **50***e* having a rectangular linear band shape, which extends along the longitudinal direction at a center portion in a width direction of the bottom plate portion **50***a* and protrudes downward. The engagement protrusion **50***e* engages with the light transmitting region **22***e* that functions as the engagement recess, and regulates the jig **50** so that the jig **50** is freely movable in the longitudinal direction and is not positionally shifted in the lateral direction. By using, as a rail, the engagement recess (light transmitting region **22***e*) engaged with the engagement protrusion **50***e*, the jig **50** is slidable in the longitudinal direction with respect to the exposure unit **22**. Accordingly, the jig **50** can be adjusted so that the region including at least a part of the gasket **25***a* of the syringe **25** is located within an imaging range of the imaging unit **21**.

Furthermore, when a type of the syringe **25** is changed, a width (body diameter) of the cylinder **25***f* of the syringe **25** is also changed according to a capacity of the syringe **25**, as shown in FIG. **7**A. Therefore, when the type of the syringe **25** is changed, it is necessary to exchange the jig **50** with those corresponding to a plurality of types of the cylinder **25***f* of the syringe **25**. At this time, an interval between the pair of side portions **50***c* is also changed, and the width or the length of the opening portion **50***d* of the bottom plate portion **50***a* is also changed. However, in the first embodiment, since it is possible to change the width of the opening portion **50***d*, the width of the engagement protrusion **50***e* can always be made constant. Therefore, a configuration including the engagement recess (light transmitting region **22***e*) of the exposure unit **22** and the engagement protrusion **50***e* of the jig **50** can support all of the syringes **25**. By using such a jig **50**, remote inspection work for the syringe **25** can be performed easily and accurately.

Here, in order to allow the width dimension of the opening portion **50***d* to correspond to the width dimension of the cylinder **25***f* of the syringe **25** for the purpose of realizing the second feature of the first embodiment, the width is adjusted by exchanging the jig **50** with a jig **50** having an opening portion **50***d* with another width dimension. As a more specific example, a jig **50** having an opening portion **50***d* with a dimension corresponding to a width of a syringe with a capacity of 2.5 ml is prepared for the syringe with a capacity of 2.5 ml with reference to FIG. **7**A. For a syringe with a capacity of 5 ml, a jig **50** having an opening portion **50***d* with a dimension corresponding to a width of the syringe with a capacity of 5 ml is prepared. For a syringe with a capacity of 10 ml, a jig **50** having an opening portion **50***d* with a dimension corresponding to a width of the syringe with a capacity of 10 ml is prepared. For a syringe with a capacity of 20 ml, a jig **50** having an opening portion **50***d* with a dimension corresponding to a width of the syringe with a capacity of 20 ml is prepared. For a syringe with a capacity of 30 ml, a jig **50** having an opening portion **50***d* with a dimension corresponding to a width of the syringe with a capacity of 30 ml is prepared. For a syringe with a capacity of 50 ml, a jig **50** having an opening portion **50***d* with a dimension corresponding to a width of the syringe with a capacity of 50 ml is prepared. In this manner, in correspondence with the capacities of the six types of syringes shown in FIG. **7**A, six types of the jigs for the six types of syringes are prepared. Moreover, in the case where the shape of the opening portion **50***d* is also always set constant, the transparent member **50***k* to be fitted to the opening portion **50***d* is partially changed to a light shielding member, whereby it is possible to change the width of the transparent region in the opening portion **50***d*.

Moreover, in another mode of realizing the second feature of the first embodiment, it is also possible to adjust the width by changing a width of the light transmitting region **22***e* between the light shielding covers **22***f*.

Moreover, in still another mode of realizing the second feature of the first embodiment, the light source **22***d* can be configured by a large number of LED light emitting elements, and an illumination width (light emitting width) can be changed on the light source **22***d* side. Among the large number of LED light emitting elements, if elements to emit light are controlled, the illumination width can be changed with ease. As a method of changing the illumination width (light emitting width) on the light source **22***d* side, for example, an input operation screen as shown in FIG. **7**B is displayed on a touch panel as an example of the first display unit **36**, and the worker selects and inputs the type of the syringe on the screen of the first display unit **36**. For example, with reference to FIG. **7**A and FIG. **7**B, for the syringe with a capacity of 2.5 ml, an icon of 2.5 ml on a left end of FIG. **7**B is pushed, and a light emitting portion **22***b* is allowed to emit light with a width of the syringe with a capacity of 2.5 ml. Similarly, for the syringes with capacities of 5 ml, 10 ml, 20 ml, 30 ml, and 50 ml, icons corresponding to the respective syringe capacities are pushed, whereby the light emitting portion **22***b* is allowed to emit light with widths of the respective syringes. In this manner, it is possible to support six types of syringes shown in FIG. **7**A.

The syringe **25** is mounted on the inspection base **23** via the exposure unit **22** and the jig **50**. In order to miniaturize a configuration of the inspection base **23**, the inspection base **23** includes the exposure unit **22** in a recess formed in an upper portion thereof as shown in FIG. **1**.

The measuring unit **29** is arranged below the inspection base **23** and measures weight of the syringe **25**. The worker not only visually inspects the amount of the drug solution **25***b*

by reading the scale of the syringe **25**, but also measures the amount of the drug solution **25***b* by the measuring unit **29**, whereby a more accurate amount can be calculated. For example, the weight of the syringe **25** that does not contain the drug solution **25***b* is measured in advance, and thereafter, the weight of the syringe **25** that contains the drug solution **25***b* subjected to the mixed injection is measured, and a difference therebetween is calculated, whereby the accurate amount of the drug solution **25***b* can be obtained. Here, the mixed injection refers to mixing preparation of the drug solution **25***b* (injection drug), and the first embodiment is described by using the term of mixed injection or preparation, both of which are defined to have the same meaning.

The identifying unit **35** has a function to identify information of a prescription and the type of the drug solution **25***b*. For example, the identifying unit **35** reads a bar code of the prescription or a drug container, makes an inquiry to the preparation DB **24***a* or the diagnosis DB **24***b* of the server **24**, and acquires the information of the prescription or information of the drug solution from the preparation DB **24***a* or the diagnosis DB **24***b*. The information of the prescription and the type of the drug solution **25***b* identified by the identifying unit **35** and an inspection image of the syringe **25** captured by the imaging unit **21** are associated with each other by the first control unit **30** described later, and are stored in the evidence recording unit **24***c* of the server **24** by the first control unit **30**. In this manner, information regarding a series of mixed injection work for the drug solution **25***b* (injection drug) can be recorded. Accordingly, traceability of the mixed injection work and the inspection work for the injection drug is ensured, and investigation or reference after the work is enabled.

The first display unit **36** is arranged inside the safety cabinet **26** or in the vicinity thereof, and displays the captured image and an inspection instruction or an inspection result from the inspector. With the first display unit **36**, the worker can confirm the inspection instruction or the inspection result from the inspector, and can perform accurate mixed injection work or inspection work.

Inside the workroom **27** including the safety cabinet **26**, the first control unit **30**, a first input unit **31**, and a first communicating unit **32** are arranged in addition to the safety cabinet **26**.

The first control unit **30** controls the respective operations, i.e., an imaging operation of the imaging unit **21**; an exposing operation of the exposure unit **22**; and an identifying operation of the identifying unit **35**. Moreover, the first control unit **30** acquires information of the captured image of the syringe **25** from the imaging unit **21**, and transmits the acquired information to a second control unit **34** to inspect the amount of the drug solution **25***b* in the syringe **25**. The second control unit **34** is an example of a control unit on an inspection side.

The first input unit **31** is a unit for inputting instructions for operating the imaging unit **21** and the exposure unit **22** through the first control unit **30**. The first input unit **31** is an example of an input unit on the preparation side. The first input unit **31** is, for example, a foot switch. By using the foot switch as the first input unit **31**, the worker in the workroom **27** can make an inspection request to the inspector or a necessary operation for the inspection (for example, change of an exposure state of the exposure unit **22**, and the like) without releasing his or her hand from the syringe **25** during work. Accordingly, not only work efficiency of the worker is enhanced, but also it is unnecessary to input the instruction by taking the hand out from the safety cabinet **26** during work.

That is, an input section such as the foot switch which does not use hand is used as the first input unit **31**, whereby components directly necessary for the mixed injection of the drug solution **25***b* can be arranged inside the safety cabinet **26**, and the worker can stay in the vicinity of the safety cabinet **26** and operate the imaging unit **21**, the exposure unit **22**, and the like necessary for the mixed injection of the drug solution **25***b* from an outside of the safety cabinet **26**. Note that the first input unit **31** may also be configured to include at least any one of a trigger switch for capturing an image of the syringe **25**, an inspection request switch to the inspector, and an exposure state selection switch for changing the exposure state of the exposure unit **22**.

The first communicating unit **32** is an example of a device for allowing the worker to ask or make a request to the inspector. The worker can ask or make a request to the inspector in the inspection room **28** by voice through the first communicating unit **32** and a second communicating unit **33** in the inspection room **28**, and can thereby exchange information with the inspector. Such information exchange by voice is also managed by the server **24** through the first control unit **30** and the second control unit **34**. The first communicating unit **32** is an example of a voice communicating unit on the preparation side, and the second communicating unit **33** is an example of a voice communicating unit on the inspection side.

In the inspection room **28**, there are arranged the second communicating unit **33**, the second control unit **34**, a second input unit **37**, and a second display unit **38**. The second input unit **37** is an example of an input unit on the inspection side, and the second display unit **38** is an example of a display unit on the inspection side. The second communicating unit **33**, the second control unit **34**, the second input unit **37**, and the second display unit **38** constitute an example of an inspection confirmation device **52**. The inspection confirmation device **52** includes at least the second control unit **34** and the second display unit **38**. The inspector can perform the inspection work regarding the mixed injection of the drug solution **25***b* from the inspection room **28** as a separate room from the workroom **27** based on the image captured by the imaging unit **21**. Similarly, in the inspection room **28**, by using the second input unit **37** and the second display unit **38** which are controlled by the second control unit **34**, the inspector can observe contents of the mixed injection work of the worker in real time or promptly issue an appropriate instruction to the worker.

Moreover, based on drug information of the drug solution **25***b* stored in the preparation DB **24***a*, the drug solution inspection system **20** of the first embodiment captures the image of the syringe **25** while changing the exposure state of the exposure unit **22**, and inspects a drug amount of the drug solution **25***b* in the syringe **25**. The drug information of the drug solution **25***b* is, for example, component information such as photodegradability of the drug solution **25***b*, or color information numerically converted as a density value or a color value of the drug solution **25***b*. For example, in the case where a photodegradable component (vitamin or the like) is contained in the drug solution **25***b*, from a viewpoint of a wavelength of light, infrared light is used as illumination light from the light source **22***d* of the exposure unit **22**. Moreover, for example, in response to the density value or the color value of the drug solution **25***b*, exposure intensity (for example, three types of exposure intensity, i.e., strong, middle, and weak) or a lighting pattern of the exposure unit **22** is changed, whereby the boundary between the gasket **25***a* (refer to FIG. **2**) of the syringe **25** and the drug solution **25***b* can be made clear. In order to change the lighting pattern, for example, an

exposure time may be shortened to obtain a blinking state. Note that at least the color information is necessary as the drug information.

If the type of the drug solution **25***b* is already known in advance, it is also possible to automatically perform the adjustment of the exposure state of the exposure unit **22** (that is, the adjustment of the exposure intensity and the lighting pattern) based on an imaging result of the drug solution **25***b* and an association table between the previously stored imaging result and exposure state. Furthermore, if the drug information of the drug solution **25***b* is present, it is also possible to automatically perform the adjustment of the exposure state of the exposure unit **22** based on the drug information of the drug solution **25***b* as described above. Moreover, an experienced worker is capable of manually performing the adjustment of the exposure state of the exposure unit **22** as described later.

In this manner, according to the drug solution inspection system **20** of the first embodiment, even if the drug solution **25***b* has a dark color, the gasket **25***a* of the syringe **25** which does not transmit light therethrough and the drug solution **25***b* with a dark color which transmits light therethrough are not assimilated with each other chromatically, and the boundary between the gasket **25***a* of the syringe **25** and the drug solution **25***b* can be made clear. That is, the drug solution inspection system **20** of the first embodiment makes it possible to reliably read a scale position of the gasket **25***a*, and an accurate drug amount can be grasped and accurate visual inspection can be performed even in a state where the captured image is interposed.

As described in the first embodiment, the drug solution inspection system **20** of the first embodiment is particularly effective in the case of inspecting the drug amount of the drug solution **25***b* in the syringe **25** remotely while interposing the image captured by the imaging unit **21**. This is because, in general, in the image captured by the imaging unit **21**, the boundary between the drug solution **25***b* with a dark color and the gasket **25***a* of the syringe **25** become more difficult to observe than in the case of visual observation.

Next, a description is made of basic operations of the drug solution inspection system **20** of the first embodiment.

In the drug solution inspection system **20** of the first embodiment shown in FIG. **1**, the drug container (not shown) which contains the drug solution **25***b* and the syringe **25** for performing the mixed injection for the drug solution **25***b* are arranged inside the safety cabinet **26** in the workroom **27**, and are isolated from the external air. The safety cabinet **26** is used in the event of handling a dangerous drug such as an anticancer drug. The safety cabinet **26** sets an inner space thereof to a negative pressure state by controlling a flow of air, and prevents leakage of internal gas to the outside. The worker enters the workroom **27**, inserts both hands into opening portions (not shown) located in front of the safety cabinet **26**, and performs the mixed injection work. Here, if such series of mixed injection work can be clearly grasped as image information or the like to the extent of enabling the inspection, the inspector can carry out the inspection safely and efficiently, for example, in another room such as the inspection room **28** away from the workroom **27** as shown in FIG. **1**.

FIG. **8**A and FIG. **8**B are views showing cases where an image of the syringe **25** is captured by the imaging unit **21** of the drug solution inspection system **20** according to the first embodiment of the present invention. FIG. **8**A is a view showing an image of the syringe **25** in a state where there is no exposure from the exposure unit **22**. FIG. **8**B is a view showing an image of the syringe **25** in a state where the light source **22***d* of the exposure unit **22** is turned on and there is exposure from the exposure unit **22** (that is, a state where the syringe **25** is exposed from a back surface thereof).

In the case where there is no exposure from the exposure unit **22**, it is found that, as shown in FIG. **8**A, the color of the drug solution **25***b* and the color of the scale **25***c* and gasket **25***a* of the syringe **25** are assimilated with each other, and it is difficult to determine the positions of the gasket **25***a* and the scale **25***c*.

Meanwhile, in the case where there is exposure from the exposure unit **22**, it is found that, as shown in FIG. **8**B, the apparent color of the drug solution **25***b* is changed by transmitted light of the exposure unit **22**, which comes from the back surface of the syringe **25**, and visibility of a reading position of the scale **25***c* in the vicinity of the gasket **25***a* is enhanced. Accordingly, the inspector can read the scale **25***c* at a position indicated by an arrow **25***d* of FIG. **8**B also from the captured image, and can inspect the drug amount of the syringe **25**.

In order to further enhance the visibility of the reading position of the scale **25***c*, an exposure amount of the exposure unit **22** may be changed according to the color information of the drug solution **25***b* in the syringe **25**. Specifically, the color information of the drug solution **25***b* is numerically converted as the density value or the color value of the drug solution **25***b*, is stored in advance as drug color information in the preparation DB **24***a*, and is read out from the server **24** by the first control unit **30** as necessary. Then, the exposure amount and the like of the exposure unit **22** are changed by the first control unit **30** based on this information, whereby inspection capable of more accurately identifying the boundary in response to a plurality of types of drugs can be performed. As described above, the density value or the color value of the drug solution **25***b* is stored in advance in the preparation DB **24***a* as the drug color information, and based on this drug color information, a quantity (exposure amount), brightness, or wavelength of the light from the exposure unit **22** is changed by the first control unit **30**, whereby inspection for amounts of the drug solutions corresponding to a plurality of types of drugs can be carried out.

As shown in FIG. **3**, with regard to an irradiation position of the light from the exposure unit **22**, the light only needs to be radiated onto a position including at least a part of the gasket **25***a* of the syringe **25**. This is because, since a shape of the gasket **25***a* of the syringe **25** is predetermined in general, it is possible for the inspector to carry out the inspection by assuming the position of the gasket **25***a* and the drug amount if apart of the gasket **25***a* can be identified. However, in order to inspect the drug amount more accurately, the light from the exposure unit **22** is desirably radiated onto a region including the entire gasket **25***a* and having a width substantially equal to the width of the syringe **25**, as shown in FIG. **8**B. In the first embodiment, the light from the exposure unit **22** is radiated onto the region having a width substantially equal to the width of the syringe **25**, whereby the light can be radiated from the opening portion **50***d* such that unnecessary light does not enter the imaging unit **21**, and the visibility of the cylinder **25***f* can be enhanced.

The exposure unit **22** may be configured to establish at least any state of a lighting state, a multi-stage illuminance state, and a contrast pattern state by the control in the first control unit **30**. In the lighting state, the entire syringe **25** is exposed, and therefore, the visibility of the reading position of the scale **25***c* of the syringe **25** can be enhanced. Moreover, in the multi-stage illuminance state, in a process where the exposure state is gradually brightened (or gradually darkened), the visibility of the reading position of the scale **25***c* of the syringe **25** can be enhanced without depending on the color informa-

tion of the drug solution **25***b*. Furthermore, in the contrast pattern state, unnecessary light does not enter the imaging unit **21** as described later, and the imaging unit **21** is capable of fine gain adjustment corresponding to the color information of the drug solution **25***b* in the syringe **25**, and the visibility of the reading position of the scale **25***c* can be enhanced.

FIG. **9** is a plan view of a case of observing the syringe **25** while changing the exposure state of the exposure unit **22** of the drug solution inspection system **20** according to the first embodiment of the present invention to a contrast pattern state. That is, FIG. **9** is a view for explaining the second feature of the first embodiment.

As shown in FIG. **9**, the exposure unit **22** incorporated in the inspection base **23** performs exposure on the syringe **25** held on the pair of side portions **50***c* of the jig **50**, from the back surface of the syringe **25**, through the opening portion **50***d* of the jig **50**. As shown in FIG. **9**, as an example, a light emitting surface **22***a* of the light source **22***d* of the exposure unit **22** in the first embodiment has a region wider than the syringe **25**.

In the first embodiment, on the light emitting surface **22***a* of the exposure unit **22**, the light emitting portion **22***b* in the vicinity of the syringe **25** and extinguished portions **22***c* adjacent thereto are provided. For example, the light emitting portion **22***b* is the light transmitting region **22***e* described above, and the extinguished portions **22***c* are the light shielding covers **22***f* described above. Hence, the illumination from the light source **22***d* is shielded by the extinguished portions **22***c* (light shielding covers **22***f*), but transmits through the light emitting portion **22***b* (light transmitting region **22***e*) such that only the vicinity of the syringe **25** is exposed. In this manner, unnecessary light does not enter the imaging unit **21** that captures an imaging range **21***a* surrounded by a broken line, and the imaging unit **21** can carry out the fine gain adjustment corresponding to the color information of the drug solution **25***b* in the syringe **25**. Hence, as shown in FIG. **9**, only the vicinity of the syringe **25** is exposed by the light emitting portion **22***b*, whereby the visibility of the reading position of the scale **25***c* can be enhanced, and accordingly, it is possible to more reliably read the position of the gasket **25***a* and grasp the accurate amount of the drug solution **25***b* to thereby perform accurate visual inspection. Here, the exposure of only the vicinity of the syringe **25** is, as shown in FIG. **9**, exposure of only a region, i.e., the light emitting portion **22***b* (light transmitting region **22***e*), which has a width substantially equal to that of the cylinder **25***f* of the syringe **25** and includes at least the cylinder **25***f* of the syringe **25**.

Next, a description is made of a flow of preparation and inspection of the drug solution with reference to FIG. **10**.

FIG. **10** is a view showing an example of a flowchart of preparation work and inspection work for the drug solution, which is carried out by using the drug solution inspection system **20** according to the first embodiment of the present invention.

As shown in FIG. **10**, when starting the mixed injection of the drug solution, firstly, the worker turns on a switch for acquiring the image of the syringe **25** on the first input unit **31** (step S**11**).

Then, based on at least one of the component information and color information of the drug solution **25***b* which is stored in the preparation DB **24***a* of the server **24**, the first control unit **30** performs the adjustment of the exposure state of the exposure unit **22** such that the positions of the gasket **25***a* and the scale **25***c* can be clearly determined (step S**12**). Here, the adjustment of the exposure state may be performed automatically by the first control unit **30**, or may be performed manually by the worker. In the case where the adjustment is performed manually by the worker, there are exemplified work of exchanging the jig **50**; and work of exchanging the light shielding covers **22***f* with those in which the width of the light transmitting region **22***e* is substantially equal to the width of the syringe **25**. In the case where the adjustment is performed automatically by the first control unit **30**, the first control unit **30** controls operations of the elements which emit light in the light emitting portion **22***b*, such that the width of the light emitting portion **22***b* becomes substantially equal to the width of the syringe **25**.

Subsequently, the image of the exposed syringe **25** is captured by the imaging unit **21** and then displayed on the first display unit **36** by the first control unit **30** (step S**13**).

Subsequently, the worker confirms the image on the first display unit **36**, and confirms contents of the exposure (step S**14**). Here, in the case where the worker determines that the exposure is insufficient or excessive (No in step S**14**), the process returns to step S**12**, and the exposure state is adjusted by an exposure state selection switch (not shown) or the like of the first input unit **31**.

In the case where the exposure is optimized by the automatic adjustment or manual adjustment of the exposure, and the reading position of the scale **25***c* of the gasket **25***a* can be clearly determined (Yes in step S**14**), the worker switches on an inspection start button on the first input unit **31** for making an inspection request to the inspector. Then, in order to inspect the amount of the drug solution **25***b* in the syringe **25**, the information of the captured image of the syringe **25** is transmitted from the first control unit **30** to the second control unit **34**. When the information is transmitted to the second control unit **34**, the image of the syringe **25** is displayed on the second display unit **38** by the second control unit **34** (step S**15**).

Then, the inspector reads the amount of the drug solution **25***b* in the syringe **25** from the image of the syringe **25** displayed on the first display unit **36**, and determines whether the inspection for the mixed injection of the drug solution **25***b* is OK or NG (step S**16**).

Here, in the case where the inspector determines that the inspection result of the mixed injection of the drug solution **25***b* is OK (Yes in step S**15**), the inspector switches on an approval button on the second input unit **37**. Thereafter, the inspector determines whether or not there is subsequent mixed injection work to be performed next (step S**17**).

Then, if there is subsequent mixed injection work to be performed next (Yes in step S**17**), the process returns to the point before step S**11** which is the point of starting time, and repeat the mixed injection work and the inspection work which are similar to the previous steps for another mixed injection work from step S**11**. On the other hand, if there is no subsequent mixed injection work for the drug solution **25***b*, the inspector carries out final inspection of performing the overall inspection and putting an electronic seal of approval (step S**18**), and ends the mixed injection of the drug solution.

However, if the inspector determines that the inspection cannot be carried out or the inspection result is NG, for example, due to the reason that the amount of the drug solution **25***b* cannot be read or the amount of the drug solution **25***b* is wrong (No in step S**16**), the inspector switches on an NG button on the second input unit **37** (step S**19**). Then, the inspector issues a correction instruction to the worker by the second input unit **37** (step S**20**). For example, based on information inputted from the second input unit **37**, this correction instruction is displayed on the first display unit **36** by the control of the second control unit **34** and the first control unit **30**. The worker corrects the work based on contents of the

correction instruction displayed on the first display unit **36** (step S**21**), and along the contents of such correction, similar mixed injection work and inspection work are repeated from step S**11**. That is, the process returns from step S**21** to step S**11**.

Through the series of work described above, the inspector can grasp the accurate amount of the drug solution **25***b* and carry out the accurate inspection while being at the place away from the workroom **27**. Accordingly, the inspection can be carried out safely and efficiently without applying a load on the inspector.

FIG. **11** is a configuration view showing a schematic configuration of a drug solution inspection system **40** according to another mode of the first embodiment of the present invention. The drug solution inspection system **40** shown in FIG. **11** is different from the drug solution inspection system **20** shown in FIG. **1** in that a plurality of workrooms **41**, **42** and **43** are provided, an imaging unit (not shown) and an exposure unit (not shown) are arranged in each of the workrooms **41**, **42** and **43**, and pluralities of imaging units and exposure units are provided as a whole. For example, the workrooms **41**, **42** and **43** are clean rooms. In FIG. **11**, an internal configuration of each of the workrooms **41**, **42** and **43** has the same structure as that of the workroom **27** in the embodiment described above, and accordingly, a detailed description thereof is omitted.

As shown in FIG. **11**, the drug solution inspection system **40** in another mode of the first embodiment includes a server **24** which manages a preparation DB **24***a* regarding the respective drug solutions **25***b* in the respective mixed injection work and inspection work in the workrooms **41**, **42** and **43**. Then, in each of the workrooms **41**, **42** and **43**, the drug solution inspection system **40** in another mode of the first embodiment captures an image of the syringe while changing the exposure state of the exposure unit by the first control unit **30**, and enables the inspector to inspect the amount of the drug solution **25***b*. In this manner, in one inspection room, the inspector can efficiently carry out the inspection sequentially for all of the plurality of mixed injection work steps. Hence, the inspector can carry out the inspection without sequentially moving to the respective workrooms.

In accordance with the above-described embodiments of the present invention, even if the drug solution has a dark color, a contrivance is made to the illumination for exposure on the syringe **25**, whereby the boundary between the gasket **25***a* of the syringe **25** and the drug solution **25***b* can be made clear, the position of the gasket **25***a* can be reliably read, the accurate amount of the drug solution can be grasped, and the accurate inspection can be carried out.

Note that arbitrary embodiments or modes among various embodiments or modes described above are combined with one another as appropriate, whereby effects inherent in the respective embodiments or modes can be obtained.

The drug solution inspection device and drug solution inspection method of the present invention are capable of performing accurate inspection based on the accurate amount of the drug solution, even if the drug solution has a dark color, and for example, are useful in performing the mixed injection work and the inspection work at different places in a hospital.

The entire disclosure of Japanese Patent Applications Nos. 2012-142638 and 2013-110878 filed on Jun. 26, 2012 and May 27, 2013, including specification, claims, drawings, and summary are incorporated herein by reference in its entirety.

Although the present invention has been fully described in connection with the preferred embodiments thereof with reference to the accompanying drawings, it is to be noted that various changes and modifications are apparent to those skilled in the art. Such changes and modifications are to be understood as included within the scope of the present invention as defined by the appended claims unless they depart therefrom.

What is claimed is:

1. A drug solution inspection device for inspecting an amount of a drug solution in a syringe, the device comprising:
- a light source that performs exposure on the syringe mounted on a jig having a transmitting portion;
- an imager that captures an image of the syringe exposed by the light source through the transmitting portion; and
- a controller that controls the imager and the light source to acquire inspection information of the drug solution,
- wherein the controller that controls the light source to change an exposure state of the light source based on drug solution color information regarding the drug solution in the syringe.

2. The drug solution inspection device according to claim **1**, wherein a width of the transmitting portion is substantially equal to a width of a cylinder of the syringe mounted on the jig.

3. The drug solution inspection device according to claim **1**, wherein a width and a length of the transmitting portion are substantially equal to a width and a length, respectively, of a cylinder of the syringe mounted on the jig.

4. The drug solution inspection device according to claim **1**, further comprising:
- a transparent member that is arranged in the transmitting portion.

5. The drug solution inspection device according to claim **1**, wherein the light source has a linear band-shaped recess at a center thereof, and
- the jig has a linear band-shaped protrusion at a bottom portion of the jig, and the protrusion engages with the recess.

6. The drug solution inspection device according to claim **1**, wherein the jig is one of a plurality of jigs having different transmitting portion widths, the plurality of jigs corresponding to a plurality of syringes having different cylinder widths.

7. The drug solution inspection device according to claim **1**, wherein the controller controls the light source to expose a region including at least a gasket of the syringe.

8. The drug solution inspection device according to claim **1**, further comprising:
- a safety cabinet in which the imager, the light source, and the jig are arranged.

9. The drug solution inspection device according to claim **8**, further comprising:
- a display inside the safety cabinet, the display displaying an inspection instruction or an inspection result from an inspector.

10. The drug solution inspection device according to claim **1**, further comprising:
- an identifier that identifies information of a prescription and a type of the drug solution,
- wherein the controller changes the exposure state of the light source based on the information of the prescription and the type of the drug solution identified by the identifier and the image of the syringe captured by the imager.

11. A drug solution inspection system comprising:
- the drug solution inspection device according to claim **8**; and
- an inspection confirmation device that receives inspection information transmitted from the drug solution inspection device to inspect the inspection information,

wherein the inspection confirmation device is arranged in an inspection room which is different from a workroom in which the safety cabinet is mounted.

12. A drug solution inspection method in which an amount of a drug solution in a syringe is inspected, the method comprising:

inspecting the amount of the drug solution in the syringe using the drug solution inspection device according to claim **1**.

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